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REVIEWS

Les tremblements de terre et les systèmes de déformation tétraédrique de l'écorce terrestre. ("Earthquakes and the tetrahedral deformations of the globe.") Par M. MONTESSUS DE BALLORE. *Annales de Géographie*, No. 79, XV, 1–8, Paris, 1906.

Six months ago we called attention in this *Journal* (Vol. XIII, p. 462) to a notable paper by M. Montessus de Ballore upon the distribution of earthquakes. The author of that article has another in the *Annales de Géographie* for January, 1906, upon "Earthquakes and the Tetrahedral Deformation of the Globe," which is well worthy of especial attention in connection with the general subject of earthquakes and their distribution. Evidently the theory of the tetrahedral form of the earth — a theory so much favored by M. de Lapparent and by Michel-Lévy—is regarded by the author as worthy of serious consideration in connection with the study of the distribution of earthquakes. The following are the general conclusions formulated in the course of the article:

1. Considering the matter from a purely geographic point of view, earthquakes occur about equally and almost exclusively along two narrow zones that follow two great circles of the earth: the Mediterranean (or Alpino-Caucasian-Himalayan) circle, with 53 per cent. of the recorded shocks, and the circum-Pacific (or Ando-Japan-Malay) circle, with 41 per cent. of the shocks.

2. These seismic zones coincide exactly with the geosynclinal zones of the secondary epoch which during the Tertiary were thrown into mountain chains or geosynclines by the foldings and displacements.

3. The folded structure of the geosynclines is seismically unstable, while that of the tabular continental areas, on the contrary, is stable.

4. Finally, it is concluded that the existence, well established by observations, of two great circles of maximum seismic unstability affords no argument in favor of the theory of the tetrahedral deformation of the globe. On the contrary, it would be surprising if there were no relations between the earthquake regions of the earth and the elements of the tetrahedron, if such a solid really determined the most general movements of the surface of this planet.

It may be added by way of postscript, and for the benefit of students of seismologic phenomena, that a new volume of five hundred pages by M. Montessus de Ballore, entitled *Les tremblements de terre*, has been recently published at Paris. In the preface M. de Lapparent directs attention to the great statistical value of the author's catalogue of earthquakes, and to the fact that he has brought seismology into its relations with geologic structure.

J. C. BRANNER.

The Linear Force of Growing Crystals, and an Interesting Pseudo-Solid. By G. F. BECKER AND A. L. DAY. Proceedings of the Washington Academy of Sciences, Vol. VII (1905), pp. 251–300.

About six months ago a modest paper, filling only five octavo pages, was published by George F. Becker and Arthur L. Day upon the "The Linear Force of Growing Crystals."[1] The writer has looked in vain for expressions of appreciation of this important piece of work.

Evidences of the linear force of growing crystals have long been familiar to geologists, but while the process of growth seemed clear enough from field observations, the demonstration of it and its quantitative determination have hitherto been altogether lacking, while the writer's efforts to interest chemists and physicists competent to deal with the problem have failed of success for twenty years. Discussions of the origin of secondary veins usually proceed on the theory of cavities, or of the replacement of one mineral by another. So far as we now recall, not one of the many writers on this much-discussed subject has ventured the suggestion that the growing force of crystals may have thrust apart the rock walls, and thus made room for the veins in the very process of formation. A few geologists have suggested that some such force operated in the formation of veins, but these are so few, and their suggestions have been made with such apparent hesitation, that little or no attention has been paid to them by the more voluminous writers upon ore deposits.

In 1882 Chamberlin recognized the displacing force of growing crystals of sphalerite, galenite, and pyrite in the ore deposits of southwestern Wisconsin, as indicated by the following quotations from Vol. IV of *Geology of Wisconsin:*

> In most instances it is perfectly clear, from the nature of the ore filling, that the separation of the beds took place before the implanting of the ores,

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[1] *Proceedings of the Washington Academy of Sciences*, Vol. VII (July, 1905), pp. 283–88.